



Atomic Energy
Control Board

P.O. Box 1046
Ottawa, Canada
K1P 5S9

Commission de contrôle
de l'énergie atomique

C.P. 1046
Ottawa, Canada
K1P 5S9

INFO-0210 (E)

RADIOACTIVE RELEASE DATA
FROM CANADIAN
NUCLEAR GENERATING STATIONS
1972 to 1985

Compiled by
Radiation Protection Division
Atomic Energy Control Board
Ottawa, Canada

September 1986

**RADIOACTIVE RELEASE DATA
FROM CANADIAN NUCLEAR
GENERATING STATIONS: 1972-85**

A. INTRODUCTION

The Atomic Energy Control Board requires Derived Release Limits (DRLs)* to be established for controlling releases of radioactive materials from licensed nuclear generating stations during routine operations. DRLs are calculated rate values for releases which, if reached, would result in the maximum permitted radiation dose to a member of the public living at the boundary of the facility, considering all environmental pathways of exposure and using very conservative assumptions. The dose limits set out in the Atomic Energy Control Regulations for members of the public are given in Table 1.

Table 1: Statutory Dose Limits - Public

Organ or Tissue	Annual Dose Limits
Whole-Body, Gonads, Red Bone Marrow	0.5 rem (5 mSv)
Skin, Bone, Thyroid	3 rem (30 mSv) (1/2 this value for children up to 16 yrs.)
Other Single Organs or Tissues	1.5 rem (15 mSv)
Extremities	7.5 rem (75 mSv)

mSv = millisievert

Since more than one radionuclide is invariably released, and both airborne and waterborne pathways are involved, a summation must be done. Dose limitation requirements will be met if during operations:

$$\sum \frac{R_{ij}}{DRL_{ij}} \leq 1$$

where R_{ij} = actual release of radionuclide i from mode of release j ;
and DRL_{ij} = Derived Release Limit for radionuclide i from mode of release j .

When deriving the release limits, site-specific data or appropriate transferred values are used in the pathways analysis model. Input parameters used in the model are conservative, and this inherent conservatism ensures that if the releases are below the DRL values, the annual dose limits will be respected.

It should be noted that because of the conservatism in the DRL calculations, any attempt to determine an actual individual dose by prorating the release data may result in an overestimate.

* DRL and DEL, Derived Emission Limit, are synonymous.

B. STATION LIMITS

The DRLs for Canadian nuclear generating stations are given in Table 2. They are expressed on an annual basis but it should be noted that for administrative purposes, DRLs are customarily broken down into weekly or monthly values.

Table 2: Annual Derived Release Limits^a for Radionuclide Components from Nuclear Generating Stations in Canada

Notes:

- All units are in TBq a⁻¹ except noble gases. (1 TBq=10¹²Bq=27 curies) Since noble gases are inert and do not interact with the human body, one can measure the external dose from the mean gamma ray energy per disintegration rate of all noble gas radionuclides present. The unit for noble gases is gamma TBq.MeV a⁻¹.
- At the time that Pickering B emission limits were derived, the limits for Pickering A were reviewed. The result is that new DRLs for gaseous emissions apply as of January 1983 (numbers in parentheses). The DRLs for liquid emissions remained unchanged.
- The recently calculated carbon-14 DRLs do not appear in this publication but will be added in future editions.

Station \ Component	2.1 AIRBORNE			
	Tritium	Iodine -131	Noble gases	Particulates
	(2.7 x 10 ⁵) ^b	(4.2)	(10.4 x 10 ⁴)	(10.8)
Pickering A	3.8 x 10 ⁵	0.8	8.7 x 10 ⁴	1.9
Pickering B	2.7 x 10 ⁵	4.2	10.4 x 10 ⁴	10.8
Douglas Point	15.0 x 10 ⁵	6.0	29.0 x 10 ⁴	14.0
NPD	6.7 x 10 ⁵	11.5	15.0 x 10 ⁴	29.0
Bruce A	3.8 x 10 ⁵	3.3	8.3 x 10 ⁴	8.3
Bruce B	6.1 x 10 ⁵	3.3	44.0 x 10 ⁴	8.3
Gentilly 1	10.0 x 10 ⁵	3.5	4.6 x 10 ⁴	8.6
Gentilly 2	3.5 x 10 ⁵	1.7	8.1 x 10 ⁴	4.6
Point Lepreau	15.6 x 10 ⁵	2.6	36.0 x 10 ⁴	24.0

(Table 2 continued next page)

Table 2 continued

Station \ Component	2.2 WATERBORNE	
	Tritium	Gross beta & gamma
Pickering A	6.2×10^5	34.0
Pickering B	6.2×10^5	34.0
Douglas Point	3.5×10^5	2.0
NPD	1.0×10^5	5.3
Bruce A	5.3×10^5	28.0
Bruce B	5.3×10^5	28.0
Gentilly 1	0.9×10^5	4.9
Gentilly 2	1.6×10^5	8.9
Point Lepreau	48.0×10^5	4.0

C. RELEASE DATA

Radioactive release data from Canadian nuclear generating stations in the years 1972 to 1985 are reported in Tables 3a through 11b. The units are TBq a^{-1} except for noble gases where the unit is $\text{gamma TBq.MeV a}^{-1}$.

<u>Station</u>	<u>Page</u>
Pickering A	4-5
Pickering B	6
Douglas Point	7-8
NPD	9-10
Bruce A	11
Bruce B	12
Gentilly 1	13-14
Gentilly 2	15
Point Lepreau	16

Table 3a. Annual activity released in gaseous effluents from Pickering NGS "A"

Radionuclides Year	Tritium	Iodine -131	Noble Gases	Particulates
1972	5.3×10^2	49.0×10^{-5}	180.0×10^2	50.0×10^{-5}
1973	14.0×10^2	20.0×10^{-5}	150.0×10^2	41.0×10^{-5}
1974	9.2×10^2	15.0×10^{-5}	1.6×10^2	140.0×10^{-5}
1975	7.6×10^2	4.1×10^{-5}	1.9×10^2	27.0×10^{-5}
1976	8.9×10^2	5.6×10^{-5}	1.0×10^2	10.0×10^{-5}
1977	16.0×10^2	6.7×10^{-5}	1.6×10^2	27.0×10^{-5}
1978	9.6×10^2	5.6×10^{-5}	1.5×10^2	11.0×10^{-5}
1979	15.0×10^2	7.8×10^{-5}	2.2×10^2	4.1×10^{-5}
1980	6.8×10^2	16.0×10^{-5}	2.4×10^2	12.0×10^{-5}
1981	5.8×10^2	6.3×10^{-5}	2.5×10^2	17.0×10^{-5}
1982	6.8×10^2	6.9×10^{-5}	2.2×10^2	17.0×10^{-5}
1983	6.6×10^2	13.0×10^{-5}	3.5×10^2	2.7×10^{-5}
1984	4.3×10^2	6.2×10^{-5}	1.7×10^2	2.1×10^{-5}
1985	3.9×10^2	5.6×10^{-5}	1.9×10^2	27.0×10^{-5}

Table 3b. Annual activity released in liquid effluents from Pickering NGS "A"

Year \ Radionuclides	Tritium	Liquid gross beta & gamma
1972	0.4×10^2	10.0×10^{-2}
1973	1.9×10^2	6.7×10^{-2}
1974	5.4×10^2	9.6×10^{-2}
1975	3.9×10^2	3.7×10^{-2}
1976	2.2×10^2	3.0×10^{-2}
1977	7.0×10^2	3.0×10^{-2}
1978	120.0×10^2	3.0×10^{-2}
1979	140.0×10^2	3.7×10^{-2}
1980	4.7×10^2	1.3×10^{-2}
1981	2.8×10^2	0.8×10^{-2}
1982	3.7×10^2	1.8×10^{-2}
1983	3.7×10^2	3.3×10^{-2}
1984	3.3×10^2	2.7×10^{-2}
1985	3.3×10^2	3.2×10^{-2}

Table 4a. Annual activity released in gaseous effluents from Pickering NGS "B"

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1984	46.3	1.6×10^{-4}	1.7×10^2	1.2×10^{-5}
1985	144.3	0.4×10^{-4}	1.8×10^2	1.3×10^{-5}

Table 4b. Annual activity released in liquid effluents from Pickering NGS "B"

Year \ Radionuclides	Tritium	Liquid gross beta & gamma
1984	3.3×10^2	2.7×10^{-2}
1985	3.8×10^2	0.9×10^{-2}

Table 5a. Annual activity released in gaseous effluents from Douglas Point NGS

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1972	2.7×10^2	0.08×10^{-5}	2.7×10^3	5.6×10^{-6}
1973	7.4×10^2	71.0×10^{-5}	5.0×10^3	24.0×10^{-6}
1974	1.9×10^2	180.0×10^{-5}	0.8×10^3	18.0×10^{-6}
1975	5.5×10^2	130.0×10^{-5}	1.0×10^3	13.0×10^{-6}
1976	13.0×10^2	60.0×10^{-5}	1.0×10^3	8.5×10^{-6}
1977	4.3×10^2	34.0×10^{-5}	0.3×10^3	6.3×10^{-6}
1978	6.1×10^2	34.0×10^{-5}	0.4×10^3	8.9×10^{-6}
1979	2.4×10^2	4.2×10^{-5}	0.7×10^3	8.1×10^{-6}
1980	1.5×10^2	6.0×10^{-5}	0.2×10^3	3.6×10^{-6}
1981	4.2×10^2	440.0×10^{-5}	1.2×10^3	36.0×10^{-6}
1982	3.2×10^2	340.0×10^{-5}	2.3×10^3	17.0×10^{-6}
1983	3.7×10^2	5.4×10^{-5}	1.7×10^3	4.8×10^{-6}
1984	3.2×10^2	1.6×10^{-5}	1.2×10^3	2.9×10^{-6}
1985	2.6×10^2	ND*	ND	ND

* ND = not detected

Table 5b. Annual activity released in liquid effluents from Douglas Point NGS

Year	Radionuclides	Tritium	Liquid gross beta & gamma
1972		1.6×10^2	15.0×10^{-2}
1973		2.8×10^2	7.4×10^{-2}
1974		1.3×10^2	4.4×10^{-2}
1975		1.0×10^2	3.0×10^{-2}
1976		1.7×10^2	3.0×10^{-2}
1977		0.7×10^2	0.7×10^{-2}
1978		0.4×10^2	0.7×10^{-2}
1979		1.3×10^2	0.9×10^{-2}
1980		1.3×10^2	1.0×10^{-2}
1981		0.8×10^2	0.7×10^{-2}
1982		1.2×10^2	1.9×10^{-2}
1983		4.0×10^2	1.6×10^{-2}
1984		1.4×10^2	0.2×10^{-2}
1985		0.5×10^2	0.8×10^{-2}

Table 6a. Annual activity released in gaseous effluents from NPD

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1972	1.4×10^2	6.7×10^{-10}	0.6×10^3	ND*
1973	4.9×10^2	140.0×10^{-5}	4.5×10^3	410.0×10^{-6}
1974	2.8×10^2	4.8×10^{-5}	4.1×10^3	ND
1975	4.7×10^2	ND	1.8×10^3	5.0×10^{-6}
1976	5.5×10^2	ND	1.9×10^3	ND
1977	6.6×10^2	ND	1.5×10^3	ND
1978	7.4×10^2	ND	1.3×10^3	ND
1979	8.4×10^2	ND	1.5×10^3	ND
1980	4.4×10^2	ND	1.4×10^3	ND
1981	7.8×10^2	ND	0.9×10^3	ND
1982	4.3×10^2	ND	0.8×10^3	ND
1983	5.2×10^2	ND	1.4×10^3	ND
1984	4.4×10^2	ND	1.7×10^3	ND
1985	3.7×10^2	ND	1.8×10^3	ND

* ND = not detected

Table 6b. Annual activity released in liquid effluents from NPD

Year	Radionuclides	Tritium	Liquid gross beta & gamma
1972		27.0	1.0×10^{-3}
1973		180.0	3.7×10^{-3}
1974		35.0	3.7×10^{-3}
1975		82.0	4.7×10^{-3}
1976		55.0	1.2×10^{-3}
1977		36.0	1.4×10^{-3}
1978		51.0	2.4×10^{-3}
1979		190.0	1.3×10^{-3}
1980		170.0	0.9×10^{-3}
1981		300.0	1.2×10^{-3}
1982		94.0	0.6×10^{-3}
1983		84.0	1.6×10^{-3}
1984		22.0	24.0×10^{-3}
1985		127.0	27.0×10^{-3}

Table 7a. Annual activity released in gaseous effluents from Bruce NGS "A"

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1976	0.1×10^3	1.8×10^{-9}	0.2×10^2	0.7×10^{-5}
1977	0.3×10^3	4.6×10^{-4}	13.0×10^2	9.2×10^{-5}
1978	0.5×10^3	1.1×10^{-4}	15.0×10^2	140.0×10^{-5}
1979	1.4×10^3	5.0×10^{-4}	30.0×10^2	13.0×10^{-5}
1980	1.6×10^3	1.3×10^{-4}	8.3×10^2	5.7×10^{-5}
1981	3.4×10^3	1.0×10^{-4}	6.1×10^2	9.5×10^{-5}
1982	1.5×10^3	12.0×10^{-4}	5.1×10^2	8.9×10^{-5}
1983	3.9×10^3	3.7×10^{-4}	6.7×10^2	5.0×10^{-5}
1984	2.5×10^3	28.0×10^{-4}	8.0×10^2	5.9×10^{-5}
1985	1.5×10^3	0.5×10^{-4}	8.0×10^2	44.0×10^{-5}

Table 7b. Annual activity released in liquid effluents from Bruce NGS "A"

Year \ Radionuclides	Tritium	Liquid gross beta & gamma
1976	1.4	0.1×10^{-2}
1977	0.3×10^2	2.3×10^{-2}
1978	1.5×10^2	18.0×10^{-2}
1979	5.5×10^2	21.0×10^{-2}
1980	9.0×10^2	16.0×10^{-2}
1981	7.4×10^2	0.8×10^{-2}
1982	9.7×10^2	0.8×10^{-2}
1983	16.0×10^2	7.1×10^{-2}
1984	6.0×10^2	7.2×10^{-2}
1985	10.6×10^2	9.0×10^{-2}

Table 8a. Annual activity released in gaseous effluents from Bruce NGS "B"

Radionuclides Year	Tritium	Iodine -131	Noble Gases	Particulates
1984	2.6	4.4×10^{-6}	28.7	1.2×10^{-4}
1985	98.6	52.0×10^{-6}	106.3	2.1×10^{-4}

Table 8b. Annual activity released in liquid effluents from Bruce NGS "B"

Radionuclides Year	Tritium	Liquid gross beta & gamma
1984	0.6	0.7×10^{-2}
1985	21.5	0.7×10^{-2}

Table 9a. Annual activity released in gaseous effluents from Gentilly-1 NGS

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1972	190.0	2.7×10^{-2}	4.5×10^2	ND*
1973	54.0	ND	ND	ND
1974	95.0	ND	ND	ND
1975	68.0	ND	1.0×10^2	ND
1976	41.0	ND	ND	ND
1977	35.0	ND	0.7×10^2	ND
1978	23.0	ND	ND	ND
1979	13.0	ND	ND	ND
1980	9.9	ND	ND	ND
1981	9.5	ND	ND	ND
1982	5.1	ND	ND	ND
1983	1.3	ND	ND	ND
1984	ND	ND	ND	ND

* ND = not detected

Table 9b. Annual activity released in liquid effluents from Gentilly-1 NGS

Year \ Radionuclides	Tritium	Liquid gross beta & gamma
1972	62.0	200×10^{-2}
1973	14.0	12.0×10^{-2}
1974	41.0	4.1×10^{-2}
1975	14.0	5.6×10^{-2}
1976	260.0	0.7×10^{-2}
1977	1300.0*	2.0×10^{-2}
1978	2.1	1.0×10^{-2}
1979	0.3	1.6×10^{-2}
1980	0.4	0.2×10^{-2}
1981	8.0	0.2×10^{-2}
1982	0.05	0.06×10^{-2}
1983	0.08	0.4×10^{-2}
1984	0.1	0.1×10^{-2}

* abnormal release

Table 10a. Annual activity released in gaseous effluents from Gentilly-2 NGS

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1983	4.3	ND [*]	63.0	ND
1984	49.4	ND	25.9	ND
1985	48.8	ND	121.4	ND

^{*}
ND = not detected

Table 10b. Annual activity released in liquid effluents from Gentilly-2 NGS

Year \ Radionuclides	Tritium	Liquid gross beta & gamma
1983	0.7	17.5×10^{-3}
1984	14.1	ND
1985	30.7	9.7×10^{-3}

Table 11a. Annual activity released in gaseous effluents from Point Lepreau NGS

Year \ Radionuclides	Tritium	Iodine -131	Noble Gases	Particulates
1982	0.2	ND *	0.1	ND
1983	25.0	9.6×10^{-6}	4.3	ND
1984	2.5	ND	ND	ND
1985	110.0	4.2×10^{-6}	0.8	ND

* ND = not detected

Table 11b. Annual activity released in liquid effluents from Point Lepreau NGS

Year \ Radionuclides	Tritium	Liquid gross beta & gamma
1982	0.5	ND
1983	9.1	ND
1984	2.5	ND
1985	24.0	1.6×10^{-3}

* ND = not detected